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INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM -- SOVIET-BLOC ACTIVITIES

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I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

Artificial Earth Satellites and the Weather

The following is the substance of an article written by a Russian officer in Sovetskaya Aviatsiya.

What can be done to predict the weather more precisely?

For a long-range forecast of the weather in the Northern Hemisphere it is necessary to know the state of the weather at a given moment throughout the Northern Hemisphere. Unfortunately, there are great areas that have few or no meteorological stations. For example, there are shipboard stations in the Atlantic, but none in the Pacific or Indian Oceans; this is a serious inadequacy because 2/3 of the surface of the globe is made up of seas and oceans. Land and sea observations on a large scale are extremely difficult and costly.

Artificial earth satellites offer great prospects for the solution of this problem. With the assistance of television sets on satellites it will be possible to get a picture of the location and movement of cloud systems over the entire globe. There would seem to be no problem in getting data concerning air masses and the fronts separating them. A system of 3 or 4 satellites would be able to observe all parts of the Earth's surface as they swing around the planet in a period of 1-1/2 to 2 hours. It will be possible to discover the direction and speed of storms, how cyclones and anticyclones develop and how cold and warm air masses develop. Not only will such satellite stations determine the picture at a given moment, but they will detect the basic tendencies in development of the weather on a planet-wide basis. It will also be possible to study the movement of the geographical poles which some scientists believe exercises an influence on the course of meteorological processes. In the winter great masses of air flow into Siberia and there is an accumulation of about 14 billion tons of air; in summer it dissipates. Scientists conjecture that this causes a wandering of the geographical pole and this exerts an influence on meteorological processes on a worldwide scale.

Satellites will be able to discover new facts about the radiation balance of the Earth, a matter of immense significance in meteorology. Satellite-collected data concerning meteorological conditions in the Earth's atmosphere will serve as raw data for interpreting thermal exchange in the air and help us to understand the general circulation of the atmosphere, this leading to considerable improvement in long-range forecasting.

Automatic computers will have to be used to process the data supplied by the satellite. It is well known that any physical processes can be described by mathematical equations. By solving these equations we can get an idea on how these processes will transpire in the future. We are on the threshold of great developments in meteorology. Artificial earth satellites, used jointly with computers, will make possible a more qualitative solution of the problem of weather prediction. ("Satellites and the Weather," by Colonel N. Barbarov, Sovetskaya Aviatsiya, 9 February 1960, page 3.)

Published Soviet Moon Pictures were Composites

Without giving the source of its information, Stockholm Liberal Dagens Nyheter revealed in its 8 February issue that, according to the Soviet astronomer Alla Masevich, the published Soviet pictures of the back of the Moon were composites of a series of pictures.

The paper quoted Alla Masevich as follows: "The published moon pictures consisted of the three best photographs of those taken, with details composed in [sic] on them." (Stockholm, Dagens Nyheter, 8 February 1960.)

Methods of Space Vehicle Recovery

Soviet research rockets are penetrating farther and farther into space with an ever increasing weight in payload. The question arises, when will Man be able to ride one of these vehicles into the boundless reaches of the cosmos?

Along with the complex technical problems connected with the flight of a man into space is the problem of safely returning him to Earth. Two versions of solving this problem are given by Professor G. I. Pokrovskiy, Doctor of Technical Sciences and General-Major of the Engineering-Technical Services USSR.

The foremost task in recovering a space vehicle involves braking its speed and ensuring its stability in flight. The first method proposed by Professor Pokrovskiy is as follows. A space ship entering the atmosphere automatically opens a cone-shaped stabilizer resembling the petals of a daisy blossom. Following this a single parachute is released, then a second, and finally, a third. The parachutes brake the speed to such an extent that contact with the Earth is smooth and safe.

Another method of landing is also possible, says Professor Pokrovskiy. In this case the space vehicle is equipped with wedge-shaped wings similar to high-speed airplanes. When such a craft enters the upper layer of the atmosphere it makes a series of skips, in and out, thereby losing speed, and then glides to a landing. ("Penetration Into the Cosmos," by Prof. G. I. Pokrovskiy; Moscow, Illyustrirovannaya Gazeta, No 17(450), September 1959, page 2)

The Nature of Corpuscular Radiation in the Upper Atmosphere

A paper on the above subject, prepared by scientific workers at the Institute of Physics of the Atmosphere of the Academy of Sciences of the USSR, is summarized as follows; many details contained in the full text are not included here.

Research accomplished by the use of Soviet and American artificial earth satellites has led to the discovery of a region of intense corpuscular radiation beginning at an altitude of 400-600 km. Subsequent data, provided by cosmic rockets, have enabled us to visualize the spatial distribution of intense hard corpuscular radiation surrounding the Earth. It has become clear that there are two such belts of corpuscular radiation. The first, the inner belt, is an equatorial ring that is approximately bounded by geomagnetic latitudes $\pm 40^{\circ}$ (according to Van Allen the width of this belt is somewhat less) with a maximum concentration at an altitude of about 3,000 km (over the geomagnetic equator). The second, the outer belt, extends out to 6-8 earth radii; the maximum concentration of corpuscles is at a distance of 3.5-4 earth radii R_E. We observe characteristic "tongues" in the spatial distribution of corpuscles in the outer belt, these reaching out to the zone of maximum occurrence of auroras. The hardness of the corpuscles in the inner belt is greater than in the outer.

To explain the cloud of rapid charged particles surrounding the Earth (henceforth we will refer to this phenomenon as the "Earth's corona"), a number of authors have advanced the hypothesis of the decay of albedo neutrons with the subsequent capture of the thus-forming protons and electrons in the Earth's magnetic trap. In our opinion, however, analysis of the spatial distribution of corpuscles in both belts of the Earth's corona excludes the possibility of explaining the outer belt by the decay of albedo neutrons. The presence of the equatorial belt means that the corpuscles forming it avoid the temperate and high geomagnetic latitudes. This is evidently because geomagnetic disturbances and auroras in the higher latitudes seemingly "draw out" corpuscles from the inner belt, preventing their accumulation. This means that the equatorial belt is only replenished by corpuscles from the bottom, from the lower layers of the Earth's atmosphere.

On the other hand, the spatial distribution of the corpuscles in the outer belt clearly points to an extraterrestrial source of replenishment. Evidently, the production of this source cannot penetrate to relatively low altitudes. On the other hand, the corpuscles of the outer belt, appearing in the magnetic trap at a distance of $3.5 \div 4\ R_E$, will accumulate there in the course of a larger interval of time than at a distance of 5-6 R_E; this is because the frequency and amplitude of the geomagnetic disturbances in latitudes 50-60° (reached by the lines of force intersecting the plane of the equator at a distance of $3.5 \div 4\ R_E$) are dozens of times smaller than in the zones of maximum occurrence of auroras. This circumstance also explains the observed position of the maximum concentration of corpuscles in the outer belt. The different origin of corpuscles in the two belts is also reflected in the difference in their hardness.

Thus, from an analysis of the spatial distribution of corpuscles in the Earth's corona, we can draw the conclusion that the principal causes of leakage of corpuscles in the outer zone (and evidently in the inner zone as well) are geomagnetic disturbances and the auroras associated with them.

At the time of geomagnetic disturbances the regular character of the field at great altitudes is disrupted and the particles until then held in the trap can escape, both into interplanetary space and downward into the denser layers of the atmosphere; this causes the phenomenon of auroras.

It should be pointed out that the "supply" of corpuscles in the trap of the outer belt is small in comparison with the number of solar corpuscles which pass through an area equal to the effective area of the cross section of the Earth's magnetic field during a geomagnetic disturbance. The maximum concentration of corpuscles in the outer belt scarcely exceeds $\sim 10\ cm^{-3}$ if we assume that the mean energy of each corpuscle is $\bar{\varepsilon} \sim 10^4$ ev. Otherwise, the density of energy of the corpuscles of the Earth's corona would be greater than the density of the energy of the Earth's magnetic field at corresponding distances. With a mean energy of corpuscles greater than 10^4 ev its maximum admissible concentration will be still less. Since the Earth's field when $R \lesssim (4 \div 6)\ R_E$ in the first approximation maintains a dipole character (which can be seen from the very fact that an outer belt exists and the character of the relative distribution of corpuscles in it), the upper boundary of concentration of corpuscles should be still less.

It is apparent that the main mass of corpuscles in the outer belt should possess relatively low energies in the range of 1-10 kev. We need experimental research on corpuscles in this range of energies in the region of the outer belt. At the same time the problem of the proton component of the outer belt is of great importance. It may be assumed that protons with energy in the range of several hundred to several thousand electron-volts should be as numerous as the electrons in the outer belt.

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The fact that the inner equatorial belt is clearly separated spatially from the outer belt is a serious argument in favor of the hypothesis that the origin of both belts of the Earth's corona is different. A significant role must be played by the process of decay of albedo neutrons in the formation of the inner belt. At the present time on the basis of experimental data it is impossible to make a clear identification of the corpuscles recorded in the inner belt. These may be protons with an energy of several tens of mev or electrons of several mev, or electrons with an energy on the order of several hundreds of kev which cause X-ray radiation on entering the body of a rocket or satellite. If it is established that in the examined belt there are protons with an energy up to several tens of mev and an extremely sloping energy spectrum, it will be difficult to explain their origin by any other mechanism than the decay of albedo neutrons.

We can point to another source for the replenishment of the inner belt with corpuscles which is of considerably greater importance than the decay of albedo neutrons. It has been reported recently that at the time of a nuclear explosion on 1 August 1958 at an elevation of about 160 km over Johnston atoll, an aurora was observed in Apia in the Samoan Islands at a distance of $\sim$3,500 km from the point of the explosion. The fact that the point where the explosion took place and the point of observation lie approximately on one magnetic meridian, proves that the charged particles (causing the artificial aurora) forming during the blast (especially electrons of beta decay), moved along lines of force which passed over the magnetic equator at elevations of 500-1,000 km. The artificial aurora had an intensity of 4. Actually it evidently was brighter than that inasmuch as the violet color of the luminescence stood out clearly in the bright moonlight (an aurora of intensity 1 scarcely stands out on the background of luminescence of the night sky). The current of energy during an aurora of intensity 4 is on the order of 10 $erg/cm^2 \cdot sec$.

We can estimate that at the time of the blast of 1 August 1958 at least 10^{23} electrons fell in the magnetic trap, of them $\sim$10% at elevations of 2,000-3,000 km. If the blast had occurred at a greater altitude and in higher latitudes, the percentage of beta electrons caught in the magnetic trap should be somewhat greater.

Thus, one high-level nuclear blast can put into the equatorial belt as many hard corpuscles as can the decay of albedo neutrons during a period of $10^6 - 10^7$ seconds. Several such explosions can fill the equatorial belt with the observed number of hard corpuscles.

We can point to still another source of replenishment of the Earth's corona with hard particles. Fission products emit so-called "delayed" neutrons during ordinary (that is, low-level nuclear blasts).

During the decay of these nuetrons in the Earth's magnetic field electrons with an energy of $\sim$ 0.5 mev will form; some of these will fall into the trap.

Thus, there are two basic sources for the replenishment of the equatorial belt with corpuscles: constant and intermittent. The first, the constant source, is the decay of albedo neutrons, primarily those of relatively low energy; the second, the intermittent source, is the product of nuclear blasts which form from time to time and can considerably increase the intensity of hard corpuscular radiation in the equatorial belt. ("On The Nature of Corpuscular Radiation in the Upper Atmosphere," by I. S. Shklovskiy, V. I. Krasovskiy, and Yu. I. Gal'perin, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,799-1,806)

Interferometric Measurement of the Width of the λ5577Å [OI] Line in Auroras

At the Northern Station of the Institute of Physics of the Atmosphere of the Academy of Sciences of the USSR (Φ = 64°, Λ = 127°) interferometric measurements of the width of the forbidden line λ 5577Å [OI] were made in various forms of auroras during the winter of 1958-1959. This line has a negligibly small natural width, and since the enhancement of the line as a result of collisions can be ignored, the width of the line is completely determined by the Doppler effect. Therefore we can judge the kinetic temperature at the level of luminescence from the width of the forbidden line λ 5577Å.

Observations were made with a Fabry-Perot interferometer with glass plates (effective diameter -- 50 mm), having a multilayered dielectric coating (the coefficient of reflection of λ 5577Å was 94%). Use was made of intermediary rings of fused quartz with thicknesses of 6, 8 and 10 mm. The interference rings of the line λ 5570Å Kr1 from the krypton gas discharge pipe were printed several times in the course of exposure on the same frame as λ 5577Å [OI]. This emission was isolated by means of an interference light filter with a half-width of 80Å and maximum transmission of 35%. The focal distance of the lens was 150 mm. The interferometer was placed in an airtight chamber, thermostatically controlled with an accuracy of $\pm$0.05°. The field of the instrument was about 2 square degrees, so that it was possible to distinguish individual rays (R) and separate the upper and lower parts of ray-like arcs (RA).

The photographs were made on Dn film, highly sensitized in the manufacturing process. Exposures of several minutes were used for bright auroras and of several hours for the night sky. Calibration was accomplished by a tubular photometer simultaneously with the main photographs and at the same temperature. The instrumental contour was determined from the green line of Krypton λ 5570Å. The contour of this line was determined in the laboratory with the same interferometer with a considerably greater resolving power (the intermediary ring had a thickness of 32 mm, the diaphragm for the active diameter was 10 mm, and there was a TAIP-3 lens, f = 300 mm). By knowing the contour of the krypton line it is possible for each exposure to determine the instrumental contour, and thereafter to get the real contour of the line λ 5577Å. This operation was made by using tables.

We got about 40 interference photographs of different forms of auroras, of which we have now processed the 15 most characteristic. Figure 1 (not reproduced here) shows a typical frame of the line λ 5577Å [OI]. The inner ring of each pair belongs to λ 5577Å [OI], the outer -- to the green krypton line. It appeared that not all the contours of λ 5577Å are of a purely Doppler character. Individual cases of deviations from the Doppler contour are evidently explained by the superimposition of illumination of layers with different temperatures. In the lower parts of bright ray-like forms and homogeneous arcs there is a mean temperature of 195+25°K, in diffuse forms and with diffuse illumination -- 250±30°K. The highest temperature (325+40°K) was recorded at the time of intense pulsating forms (PS) on a background of reddish illumination. If we assume, as did Stormer, that the respective altitudes for RA and DS are 95 and 100 km, the temperature derived for them -- 195° and 250° K, agree with the temperature curve drawn by Mikhnevich. However, the temperature measured for pulsating forms does not correspond to the altitude of 195 km ascribed to it. If we do not consider the possibility of heating of the atmosphere in the regions of pulsating forms of auroras, the measured temperature on the indicated curve corresponds to an altitude of 120 km. Regrettably, the Northern Station made no parallactic determinations of the height of individual forms of auroras for which it made interference frames of the line λ 5577Å [OI].

The temperature of the unexcited night sky, measured in the photograph of the emission of λ5577Å, is 260+35°K. This value exceeds that measured by Wark and Armstrong. It is possible that this difference was caused by the heating of the upper atmosphere in high geographical latitudes. Such heating was also discovered by measurements of the rotational temperature of the OH band. ("Interferometric Measurements of the Width of the Line λ5577Å [OI] in Auroras," by T. M. Mulyarchik, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,902-1,903)

Sun, Weather and Climate

The following is the substance of a recent Izvestiya article written by Prof. M. Eigenson, Director of the L'vov "Ivan Franko" University Astronomical Observatory.

Science this year is celebrating a singular anniversary: 350 years ago Galileo, the inventor of the telescope, observed sun spots for the first time. Since that time sun spots and other active processes on the Sun have become the object of close study by astronomers and geophysicists. Abundant observational data show that not once during these 350 years has solar activity been at such an exceptionally high level as it has been (with insignificant exceptions) since 1957.

In July of this year an intense and prolonged outburst of hydrogen was observed on the Sun. The Earth's atmosphere reacted almost immediately and in a turbulent fashion to this flash-like intensification of solar activity. Intense storms developed in the ionosphere and in the Earth's magnetic field and led to a disruption of radio communication and even wire communication.

As indicated by observations made at numerous Soviet solar observatories, 1959 activity on our central luminary was exceptionally great and even somewhat exceeded the record high levels of 1957 and 1958.

The high activity of the Sun influences not only the upper layers of the atmosphere -- its influence extends far deeper. The character of solar activity appears to determine the general state of the weather and climate.

It is now becoming increasingly clear that the Earth's atmosphere is unified. The lower layers of the atmosphere, in which meteorological phenomena occur, are interconnected with its upper layers. True, there is no unanimity among geophysicists concerning the theoretical mechanism of this relationship; however, it does in fact exist.

The data of Soviet and foreign scientists show that the intensification of solar activity in the long run intensifies and even changes the general circulation of the Earth's atmosphere and the exchange of air between the different geographical regions proceeds more intensively.

In particular, as indicated by research recently accomplished at the Central Institute of Forecasts and at the Astronomical Observatory of the L'vov University "Ivan Franko," the sharp changes in temperature typical of weather in recent times is due to sharp variations in solar activity in time during its general very high level.

Soviet science has discovered the cause of this unusually high activity on the Sun. The explanation is that there is now simultaneously occurring both the 11-year "secular" maximum and a "suprasecular" maximum of solar activity.

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The 11-year cycle of solar activity has been known to science for over a century. Approximately each eleven years (the last time was in 1954) solar activity more or less reaches its lowest level. Then it begins to increase and then again begins to fall slowly until attaining its next minimum.

It has recently been determined definitely that there is a secular cycle with a mean duration 80-90 years. It appears that this cycle plays an exceptionally important role in meteorological phenomena caused by the Sun.

Finally, scientists suspect the existence of cycles of solar activity with a duration of several centuries or more -- "suprasecular" cycles.

As a result of the cyclic character of solar activity the record high levels of today will systematically begin to decline in the near future.

Inasmuch as there is a close relationship between physical conditions on the Earth and Sun, the upcoming decline in solar activity will lead to extremely noteworthy geophysical aftereffects.

We can expect that in the last decades of the present century that part of the weather-climate "machine" of our planet whose operation is effected by solar activity will be substantially weakened. The weather will become milder and more stable.

The general character of the Earth's atmosphere influences many processes developing in the globe's envelope of air. Prominent among them are such grandiose geophysical processes as variations in the ice cover of the Earth's polar regions and variations in the level of the Caspian Sea.

A decrease in solar activity will therefore lead to a certain worsening of ice conditions in the polar regions. On the other hand, the low level of the Caspian Sea (during the last 30 years it has dropped almost 3 meters!)-- will probably rise during the upcoming decades of the XX Century.

Thus, a study of the Sun makes it possible for scientists to foresee changes in the climate of the Earth for many years in advance. ("Sun, Weather and Climate," by Prof. M. Eigenson, Izvestiya, 8 December 1959, page 4)

Dependence of Seasonal Fluctuations in Geographic Longitudes on Ground-level Wind Requires Further Study

H. Krueger of the Geodetic Institute at Potsdam, German Academy of Sciences, Research Community, discusses the effect of the wind on astronomic longitude, latitude, and azimuth measurements.

The author reviews the observations made during the past 40 years by stations in Greenwich, Hamburg, Paris, Potsdam, Washington, and Tokyo, which revealed that the wind effect has become an inherent and very uniform component of observation results.

He uses graphs and tables to show the systematic seasonal influence of the wind effect, the wind effect for a certain wind speed, the dependence of seasonal fluctuations in geographic longitudes on ground-level wind and the fluctuations of geographic longitudes based on astronomic observations and the wind effect.

The author refers to N. Stoyko's research report entitled "Influence saisonnieres sur la determination des longitudes" and published by the Bureau International de l'Heure in Paris; he cites the "Normal Weather Maps" and lists his own article ("On the Influence of the Wind on Time Determinations in Tokyo, Leningrad, and Potsdam," Vermessungstechnik [Surveying Technology], No 5, 101-106, 1957). In addition to mentioning the possibility of neutralizing the seasonal fluctuations in geographic longitudes with the help of the wind effect, he brings up the problem of a possible connection between the wind effect and the pole elevations and rotation fluctuations. H. Krueger feels that all of these investigations constitute just a beginning, and hopes that there will be more cooperation between interested institutes, especially during the IGY. ("Dependence of Seasonal Fluctuations in Geographic Longitudes on Ground-level Wind," by H. Krueger, Monatsberichte der Deutschen Akademie der Wissenschaften zu Berlin, Vol 1, No 11, 1959, pages 653-658)

IV. METEOROLOGY

The Influence of Air Temperature on the Action of Silver Iodide

The effectiveness of silver iodide in inducing artificial rainfall can be reduced under the influence of solar radiation. Bolton believes that the basic cause for the breakdown of crystallization nuclei is air temperature. However, his conclusions are disputed by others. This article seeks to find the correct solution of this problem.

The authors have conducted experiments and give details concerning their methods and conclusions.

They conclude that under natural conditions, as under experimental conditions, the temperature of the atmosphere has no influence on the activity of the particles of silver iodide themselves. The deactivation of such particles as crystallization nuclei is caused in the atmosphere primarily by the influence of solar radiation. ("The Influence of Air Temperature on the Action of Particles of Silver Iodide as Crystallization Nuclei," by V. N. Balabanova, T. N. Zhigalovskaya and M. N. Maleyev, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,899-1,890)

A New Method for the Measurement of the Height of a Homogeneous Atmosphere

Ye. I. Fialko of Tomsk Polytechnic University is the author of an article on meteorology in the Izvestiya of the Academy of Sciences of the USSR, Geophysical Series. In this paper he presents a new method for measurement of the height of a homogeneous atmosphere that differs from that based on the work of Kaiser and Evans. Fialko is well qualified in this field of research due to his extensive work in the investigation of meteor trails in the atmosphere by the use of radar. ("A New Method for the Measurement of the Height of a Homogeneous Atmosphere," by Ye. I. Fialko, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,891-1,894)

Solution of an Equation for Prediction of the Field of Atmospheric Pressure

The problem of determining the state of the field of atmospheric pressure or the prediction of the baric field of the atmosphere has been solved by various methods and under various conditions. Simplifications have permitted the solution of this problem in final analytical form suitable for use in the making of a prediction.

In this article Nemchinov gives an approximate solution of an equation describing the change in the field of atmospheric pressure. The proposed method makes it possible to use the most general assumptions relative to the stratification of the atmosphere and also to take into account the presence of pseudo-adiabatic processes in the real atmosphere. The solution, however, will only be suitable for a certain combination of standard levels selected in advance. ("On the Solution of an Equation for Prediction of the Field of Atmospheric Pressure," by S. V. Nemchinov, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,821-1,830)

The Influence of Mountain Masses on Long-Range Meteorological Predictions

This article gives the complex solution of a nonlinear prognostic problem, taking into account the influence of mountain masses on the development of large-scale processes in a baroclinic atmosphere. This paper should be read in conjunction with the article on this subject by Ye. N. Blinova, appearing in the Doklady of the Academy of Sciences of the USSR, Vol 110, No 6, 1958. ("On the Calculation of the Dynamic Influence of Mountain Masses in the Nonlinear Problem of Long-Range Prediction of Meteorological Elements," by Chu Yun-ti, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,807-1,820)

V. GEOMAGNETISM

Errors in Geomagnetic Charts of the Indian Ocean

Japanese scientists have made two expeditions to the Antarctic in recent years. This article is essentially a review of the published work of Nagata, Oguti, and Kakinuma (Proceedings of the Japan Academy, 34, No 7, 1958).

Observations were made while enroute to Antarctica. The accuracy of their 3-component magnetometer was 1' for D and I and 10γ for T. Their marine magnetometer was especially designed for towing behind the ship. The instrumental accuracy of the magnetometer is determined by the accuracy of the standard oscillograph controlled by a quartz crystal. The Japanese report the highest accuracy yet received with a marine magnetometer. Comparisons of their data with the Vestine maps of 1945 show that the values for the first and second Japanese expeditions are considerably less than those on the Vestine maps. The discrepancy in T is as much as 5,000γ, which is about 10% of the normal value along the part of the Antarctic coast in the vicinity of Lutzow-Holm Bay. Observations of 1957-1958 showed that magnetic declination here was -3.5° different than that on British hydrographic charts of 1955.

Figure 2a in the text shows the distribution of T between South Africa and Antarctica (1958 data), while Figure 2b shows the same for 1945. The area shows pronounced secular changes.

The authors of the review do not feel that presently existing data permit us to accept as established fact such large secular changes as are reported by the Japanese in relatively small distances. The discrepancy may be due to the fact that the old and new observations were made at different points. Further study of this situation to the south of Africa is in order. Nevertheless there is no doubt that the maps compiled by Vestine are incorrect and that we should instead give preference to those compiled by Nagata and his associates. Magnetic measurements made on the nonmagnetic ship "Zarya" seem to confirm them. In 1958 this ship four times intersected the route taken by the Japanese ship and the recorded values for T correspond to the Japanese data, being considerably lower than those of the Vestine map. ("On Errors in Marine Charts of the Strength of the Geomagnetic Field T in the Southern Part of the Indian Ocean," by V. P. Orlov, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,870-1,872)

Variations in the Earth's Natural Electromagnetic Field

In recent years interest in the varying natural electromagnetic field of the Earth has increased greatly due to work showing great prospects for the utilization of the variations of this field for geological reconnaissance. Thus, study of the spectrum of variations of the natural field has taken on not only theoretical but also practical significance.

Up to now study and practical use have been centered primarily on low-frequency variations of the field with a frequency less than 0.1 hertz.

Beginning in 1957, in accordance with the program of the IGY, the Institute of Physics of the Earth of the Academy of Sciences of the USSR has conducted study on this subject on a broad scale. Stations are available which permit recordings of changes in the range of 0.3 - 1,000 hertz.

This article gives the results of such research in 1957-1958 in the frequency range 0.3-100 hertz.

Figure 1 [not reproduced here] is a schematic diagram of such a station; the text gives details concerning its arrangement, specifications and capacities.

A study of the spectrum of variations of the electromagnetic field was made in various regions of the European part of the USSR but was concentrated in the vicinity of Ryl'sk in Kursk Oblast. This area is made up of sandy-clayey rocks with a thickness of about 500 m; these lie above a crystalline basement, to all intents and purposes possessing an infinitely great resistance.

When recording the horizontal components of the electrical field the lines of reception were oriented northward and eastward.

The results of processing the numerous oscillograms indicates the presence in the studied electrical field of a continuous spectrum of frequencies. However the distribution of variations by frequency is uneven. In the first range (0.3-10 hertz) the maximum number of variations is in the range 6-8 hertz, in the second range (10-100 hertz) — 70-80 hertz. The distribution of variations by frequency for different times in the day is practically identical. Figure 2 [not reproduced here] shows the results of processing several oscillograms.

In the field work period of 1958 variations with a frequency less than 0.3 hertz were often recorded. The apparatus used permitted the recording of variations of such frequencies only if they had considerable amplitudes. Because of this the resulting experimental data cannot characterize the true picture of the distribution of low-frequency variations in time.

Figure 3 in the original text shows an oscillogram for the most intensive low-frequency variations -- on 8 July 1958, after an aurora, a rare phenomenon in this area. Figure 4 shows the distribution of variations by amplitudes; these vary from several tens of microvolts to several millivolts per kilometer, but most have an amplitude of 0.2 mv/km. The mean amplitude of the field by night is 25-30% less than by day. The intensity of the variations increases with a decrease in frequency.

Variations in the electrical field vary in form. During auroras we observe variations continuously following one another; they have a different period of approximately sinusoidal form. Individual impulses of the most varied form are usually recorded on calm days.

Research enables us to draw the following conclusions:

1. The Earth's magnetic field in the range 0.3-100 hertz has a continuous spectrum of frequencies.

2. The distribution of variations by frequency for different times of the day in the period of observations was practically identical.

3. The intensity of variation of the field depends on the frequency and time of day. With a decrease in frequency the amplitude of variations increases. The intensity of variations by day is somewhat greater than by night.

4. The mean amplitude of the horizontal components of the electrical field of variations of almost all frequencies in the range 0.3-100 hertz confirms the feasibility of developing a method of magnetoelectric sounding with the use of the Earth's natural varying electromagnetic field. ("On the Spectrum of Variations of the Natural Electromagnetic Field of the Earth," by N. P. Vladimirov and N. N. Nikiforova, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,867-1,869)

VI. SEISMOLOGY

Tectonic Peculiarities of the Site of Deep-Focus Earthquakes in the Eastern Carpathians

The author visited the Rumanian People's Republic in 1958 for the purpose of determining the geological conditions surrounding the origin of deep-focus earthquakes in that area. The journey was so brief that it was impossible to become fully acquainted with the Rumanian literature on the subject, much less make a thorough investigation. However the epicenter region was visited and observations were made of the structural geology and the recentmost movements in the region.

The earthquakes here occur, as in many other seismically active regions, in a sector of high contrast in very recent vertical movements. Within the area of the Carpathians and its foreland the maximum contrast is found in the vicinity of Fokshani. This can be seen by an analysis of the hyposometric map of the carpathians (in the original text). This is a region with contrasting areas of uplift and subsidence.

The structural geology of the area is briefly described but the author himself acknowledges that it is only a cursory treatment of this complex problem.

In addition to the hypsometric map there is a sketch map of the epicentral region of Carpathian earthquakes showing the intensity of the maximum tremors, another showing the hydrographic net in the area, another showing the structure of the depression in the Fokshani region, and a final map of isostatic anomalies. ("On Tectonic Peculiarities of the Site of Deep-Focus Earthquakes in the Eastern Carpathians," by V. V. Ez, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,839-1,844)

Attempt to explain the layer of Lowered Velocities in the Earth's Crust

At a depth of about 100 km there is some decrease in the velocity of seismic waves. Several authors have determined the limiting value of the temperature gradient whose presence could explain such a drop in velocities.

This article seeks to explain the origin of the layer of lowered velocities by the natural increase in temperature with depth, without bringing in additional hypotheses relative to the special physical condition of this layer. ("On the Temperature Gradient in the Upper Layers of the Earth and the Possibility of Explaining the Layer of Lowered Velocities," by Ye. A. Lyubimova, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,861-1,863)

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The Accuracy of the Method of Mean Velocities in the Seismic Properties of Refracted Waves

In seismic reconnaissance it is often necessary to deal with a refracting boundary covered by a layer in which the velocity of propagation of elastic oscillations increases with depth. In the interpretation of the hodographs from such boundaries the precise calculation of the continual change in the velocity in the covering medium can be made by the use of ray diagrams. But the drawings of ray diagrams and their use is often associated with great technical difficulties. Therefore, in the practice of seismic reconnaissance it is often necessary to settle for the use of approximate methods of interpretation. The simplest and most widely used approximate method is the method of mean velocities, based on the substitution of the real continuous covering medium with a uniform medium with a constant velocity of propagation of seismic waves equal to the mean vertical velocity in the real medium.

This article discusses the problem of the interpretation of hodographs of refracted waves in the above described media when applying the method of mean velocities to the interpretation of hodographs of refracted waves, corresponding to the horizontal refracting boundary situated under the layer in which the velocity of propagation of elastic oscillations increases linearly with depth. An effort is made to eliminate error in the application of the method of mean velocities. ("On the Accuracy of the Method of Mean Velocities in the Seismic Properties of Refracted Waves," by Ye. K. Lossovskiy, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,845-1,849)

Experimentation on Measurement of Man-Caused Microseisms in Rocks

Experiments have been made in the laboratory and in underground coal mines to determine whether it is possible to establish some scale for the small-scale microseisms associated with the shattering of rocks that will somewhat resemble the Richter scale for the classification of earthquake intensity.

Model experiments along these lines were conducted in the Laboratory for Model Work of the Institute of Physics of the Earth of the Academy of Sciences of the USSR under the direction of Yu. V. Riznichenko. Field investigations were made in the mines of the Kizel coal basin.

Figure 1 shows the distribution of the number of impulses by intensity during the shattering of rock samples in the laboratory. Figure 2 shows the distribution of the number of impulses by intensity for cases of shattering of coal in shafts. The text provides an interpretation of these experiments. ("On the Distribution of the Number of Impulses by Intensity During the Shattering of Rocks," by S. D. Vinogradov, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,850-1,852)

Report on the New Projects of the Institute

The following is the full text of a series of reports by F. Gerecke, H. Martin, and W. Sponheuer of the Institute of Soil Dynamics and Earthquake Research, Jena, German Academy of Sciences, Research Community.

Reports on the new projects of the institute, which will be published in the research issues of the Mining Academy, were covered in the lectures delivered at the Eleventh Conference of Miners and Foundrymen of the Freiberg Mining Academy held from 21-23 May 1959.

After the rockburst at Merkes/Rhoen in July 1958, the institute worked on a number of projects which were reported on in three lectures.

Makroseismic Investigations by W. Sponheuer

The region of seismic disturbance was illustrated by an isoseism map. The mine building of the potash combine is located within the area of the worst shocks. It is therefore unlikely that a separate tectonic earthquake focus exerted a concomitant effect here. This opinion is bolstered by an examination of the seismicity in that area in which no nearby earthquake focus can be proved to have existed in historic times.

With the help of the isoseism map, one can illustrate the decrease in the tremor intensity with the distance. The calculation of the focus depth of the shock, based on this value, gives us the very small value of 1 km, which is in strong contrast to the way we imagine a tectonic earthquake. If we take into consideration the deviation from the customarily assumed point-shaped focus, we get an even smaller focus depth which is on the order of magnitude of the depth of the shattered mine diggings and tunnels.

The energy of the shock, whose magnitude points to a nearby quake, can be calculated makroseismically with the help of magnitude investigations. The magnitude of work, expressed in mkg, is about equal to that resulting from the weight of the seam roof above the cavities, multiplied by a sag of only 1 cm. The shocks of Kruegershall on 24 May 1940 and Heringen on 22 February 1953 are about of the same magnitude as that of Merkers, as we can see from the size of the quake area, the focus depths, and the magnitude. All three would therefore seem to have been caused by mining operations.

The Results on the Basis of Seismic Data Registration by F. Gerecke

For our work, we had available the data registrations of 41 earthquake stations, partly as original seismograms, partly as photo copies. The earth movement caused by the rockburst was registered up to a distance of 1,281 km (Kiruna). In Jena and Goettingen, the earth movements were so great that some of the recorder pens on the seismographs fell off.

The seismographic results which have been presented give us information on the focus time, the speed of the various waves, and the depth of the Mohorovicic discontinuity. With the help of the hyperbola method, the epicenter of the quake was determined to be near Merkers, i.e., likewise within the area of the strongest tremors.

The movement direction of the first earth movements at the individual seismographic stations, both in the vertical and in the horizontal component, point almost exclusively to the focus of the tremor and that tells us that we were everywhere dealing with a dilatation. From this we can deduce that the producing mechanical process in the focus had been a release of tensions with vertical direction of movement, such as it occurred in the breakup of the seam roof due to failure of the columns. In contrast to this, the movement directions of the first earth movements give us, for tectonic quakes, a tension and pressure distribution in four quadrants. Here the focus development process is a shearing fracture.

The magnitude of the shock, calculated mikroseismically from the registrations, agrees with the makroseismically determined value.

Inclination Investigations by H. Martin

The second level was hard hit during the rockburst. In order to observe seismic processes in the mine building, a set of optically registering seismographs was set up at the edge of the faulted zone after the rockburst on the first level. We found great shifts in the zero point in the NS component which were connected with the inclinations of the bedrock. The latter have almost faded now.

In order to catch this phenomenon also in other places of the mine building, an inclinometer was built on the foundation of a hose-leveling instrument in the institute workshop. Three concrete pods each were cemented in five measurement stations in the first level in a corresponding orientation; this made it possible to make further extensive inclination measurements on whose results we are reporting now.

The following additional lectures were presented.

Vibration Investigations of the Chamber Blasting in the Stone Quarry of Rappbodesperre by H. Martin

To obtain aggregate, 30 chamber blasting operations were carried out in the Rappbodesperre stone quarry from 1950-1957; the institute participated in these blasting operations in an advisory capacity and took instrument measurements. It was the task of the institute to create a synthesis between the profitability of chamber blasting and the protection of the compressed foundation soil [building ground].

In the lowest control walk of Rappbodesperre, 13 chamber blasting operations with an average distance of 600 m from the quarry were registered and plotted. The blasting charges ranged from 1-50 t and were increased in the course of time. In large chamber blasting, the individual chambers were equipped with fuzes of varying time limit, since the maximum charge of a fuze had been fixed at 5 t on the basis of the experience of the preceding blasting operations. The control of the fuze process and the shocks, as well as the proof of sparkovers were of great importance. Sparkovers could be avoided through proper layout of the blasting chambers.

Experience and Hints in Hose-Leveling Instrument Measurements by H. Martin

These experiences are based on more than 1,000 gradient measurements we made. Among others, we tackled the problem of how one can make technically accurate measurements also under difficult conditions, e.g., under great temperature differences at one or more measuring stations, wind effect in measurements in the open air, etc. With the help of a measurement example, it was shown for the first case that one can attain one's objective without any temperature measurements by plotting several measurements in time and by extrapolating after the moment of slinging the scales. In measurements in the open air, a larger number of readings is required; here it is assumed that the wind conditions before and after the exchanging of the scales are about the same. Finally, we went into the problem of the stabilization time of the oscillations of the water column which is economically important. For this purpose, the dampened oscillations were recorded and discussed on a technical oscillation basis. ("Reports on New Projects of the Institute," by F. Gerecke, H. Martin, and W. Sponheuer, Monatsberichte der Deutschen Akademie der Wissenschaften zu Berlin, Vol 1, No 11, 1951, pages 712-715)

Differences in the Periods of Seismic Waves Stimulated During Underground Explosions and Earthquakes

Seismic recordings, obtained during powerful underground explosions using chemical explosives at epicentral distances up to several thousand kilometers, were used for explaining the character of the frequency spectrum of seismic oscillations excited in this case. A comparison of the data on the predominant periods of seismic oscillations during explosions and during shallow earthquakes equivalent in intensity are of great interest.

An explosion of 1,000 tons of ammonite was set off for scientific purposes on 19 December 1957 at 0900 GMT at a spot 30 kilometers southeast of the Tashkent railroad station of Arys' (42°12'15"N, 69°03'02.59"E). The charge was placed in a mine shaft run through clay to a depth of 40 meters. A crater 50 meters deep and 100 meters wide was formed by the explosion.

On 25 March 1958 at 0900 GMT 3,100 tons of ammonite were exploded in the Pokrovsk-Ural'skiy region (60.2°N, 59.9°E) for making a canal bed with a total length of 1,100 meters. The charge was placed in 31 pits, 10-15 meters deep in water-saturated rock formations. Seismic recordings made during this explosion were obtained at seismic stations in the USSR, Finland, Sweden, India, Africa and the USA. The most distant station which recorded the direct longitudinal P wave at an epicentral distance of 8,980 kilometers was Eureka station (USA).

In the USSR recordings of the explosions were obtained on different type seismographs: the wide-band D. P. Kirnos design seismographs (SK), more sensitive modernized seismographs (SKM), and others. For the purpose of the present work, recordings of SK seismographs were mainly used since namely for this apparatus data for earthquakes were obtained. In addition, this apparatus has the widest band with a uniform pass band in a range of periods from 0.2 to 12 seconds, and therefore, the least distorting.

All the types of waves which are excited during earthquakes with foci in the granite layer were recorded during the underground explosions. On the recordings of stations located at epicentral distances up to 1,000 kilometers the main refracted waves from the boundaries in the Earth's crust were recorded: the sedimentary stratum-granitic layer ($\overline{P}$, $\overline{S}$), the granitic-basaltic layer (P^*, S^*), the Mohorovicic boundary (P_n, S_n), and also surface waves. Information concerning hodographs of body waves and the structure of the Earth's crust in Central Asia, obtained according to the data from powerful explosions, are given in the account Godografy seysmicheskikh voln i nekotoryye osobennosti stroyeniya zemnoy kory v Sredney Azii po dannym zapisey moshchnykh vzryvov (Hodographs of Seismic

Waves and Some Peculiarities of the Earth's Crust in Central Asia According to the Data of Recordings of Powerful Explosions), by Ye. M. Butovskaya and others (Account of the Division of Seismology of the Institute of Mathematics of the Academy of Sciences Uzbek SSR, 1958), and also in the work, V. I. Bune, Ye. M. Butovskaya, Tr. Geofiz. inst. AN SSSR, No 30, 1955.

Direct longitudinal waves, P, direct transverse waves, S, and surface waves, L, were recorded at epicentral distances over 1,100 kilometers.

Figure 1a (not reproduced here) shows photo copies of the recordings of a direct wave, P, by an SVK-M seismograph during the Arys' explosion. Figures 1b and c (not reproduced here) show the recordings of horizontal seismographs (component B-3) of the explosion at Pokrovsk-Ural'skiy at a distance of 1,440 kilometers: (b) is the SGK-M Seismograph and (c) is the SGK seismograph; the component B-3 is the longitudinal one for the given station. For the same station, the longitudinal component (N-S) is also given in Figure 1c for the recording of the Caucasus earthquake (43°N, 41.5°E) of 5 July 1958, at 0205:57 hours at a distance of 1,350 kilometers by the SGK seismograph. According to the value of the magnitude, M, the explosion at Pokrovsk-Ural'skiy ($M \sim 4$) and the earthquake under consideration ($M \sim 4^3/4$) differ by $\sim 3/4$; judging by the data in Figures 2 and 3 (not reproduced here), such a difference in magnitude for earthquakes would not reveal a notable effect on the periods of seismic oscillations. In the case being considered, as obvious from Figure 1, the period of the surface wave during the explosion is smaller by a factor of five than the period of the surface wave during an earthquake at the same epicentral distance.

Nearby shallow earthquakes, recorded on the Frunze station SK type seismograph in the first half of 1958, were processed in order to be able to compare the predominant periods of seismic oscillations during the underground explosions with the predominant periods of seismic oscillations during earthquakes. The results of the processing of these earthquakes are shown in Figures 2, 3, and 4 (not reproduced here). According to the data on hand, it is impossible to establish the presence of the relationship of periods of body waves to the epicentral distance, the depth of the focus and the values of M. If such a relationship exists, then it is probably weak, and a greater number of observations and a much higher accuracy in them is necessary to reveal it.

The periods for a longitudinal wave (Figure 2) of an earthquake with $M \approx 3$-5 in the interval of epicentral distances from 100-1,000 kilometers have, in the majority of cases, a value of 0.6 to 2.0 seconds. Longitudinal waves during explosions at these same distances (see experimental points 4 in Figure 2) have periods of 0.2 to 0.8 seconds, i.e., approximately 1/3 as long.

It is interesting to note that the periods of P_n waves is somewhat less than the periods of the P* and P waves. This may be connected with the smaller values of the coefficient of absorption in the mantle in comparison to its values in the granitic and basaltic layers.

The longitudinal waves, P, were recorded by the SVK-M and Beinoff seismographs. In the recordings of these instruments the visible periods of the P waves lie within the range from 0.5 to 1.5 seconds. According to data (B. Gutenberg, Bull. Seism. Soc. Am., Vol 48, No 3, 1958), the minimal values of periods of P waves for shallow earthquakes are 1 to 3 seconds, i.e., approximately 2 times greater than during explosions.

The period for transverse waves (Figure 3) of earthquakes at epicentral distances up to 1,000 kilometers changes approximately from 1 up to 3-4 seconds. The comparison of these values with the data for explosions at considerable epicentral distances was not successful because of the difficulty in separating transverse waves due to the low resolution of the majority of the recordings of the explosions on type SK instruments obtained. The periods of direct transverse waves, S, on the recordings of SGK-M seismographs are about 1.5 seconds.

The difference in periods for earthquakes and explosions was most considerable for surface waves recorded on the wide-band SK type apparatus. The relationship of the maximum period of a surface wave during earthquakes to the epicentral distance is given in accordance with S. L. Solov'yev, N. V. Shebalin, Izv. AN SSSR, ser. geofiz., No 7, 1957: $T_\omega \approx 0.85\sqrt[3]{\Delta}$. Observations at Frunze station are in agreement with this relationship. The period of a surface wave on the recordings of the Arys' explosion in the distance interval of 300-1,100 kilometers is equal to 2+0.5 seconds. Thus, the period is practically unchanged with distance. Similar values for the periods of surface waves were obtained during the explosion at Pokrovsk-Ural'skiy at epicentral distances up to 2,200 kilometers.

Thus, as can be seen from a consideration of Figure 4, for a distance of about 200 kilometers the period of a surface wave during explosions is about 1/2 the period of surface waves during earthquakes, for a distance of 1,000 kilometers about 1/4, and for a distance of 2,000 kilometers it is approximately 1/5, therefore extreme values nowhere overlap.

This fact that the periods of surface waves during the underground explosions considered here are not changed with distance is probably due to the very narrow spectrum of these waves, which is confirmed by the presence of the long train of oscillations in the surface wave.

On the basis of the observed data the hypothesis was expressed that the high-frequency spectral composition of the oscillations during the explosions is caused by the small dimensions of the source and the short duration of its action in comparison with the dimensions of the focus and the duration of its action during earthquakes. This hypothesis is in agreement with the theoretical calculations of V. I. Kelis-Borok (V. I. Kelis-Borok, Interferentsionnyye Volny v Mnogosloynoy uprugoy srede [Interference Waves in a Multilayer Elastic Medium], Izd. AN SSSR, now in press), in accordance with which, because of the difference in the sizes of the focus, the surface waves during an explosion must have shorter periods than surface waves during earthquakes if the periods of body waves and their energy in this and other cases are equal. This conclusion is the most credible since, in accordance with the experimental data given here, the periods of the body waves during subterranean explosions are smaller than during earthquakes.

The obtained data concerning the differences in the periods of surface waves has significant value as they give a new indication for reliably distinguishing the recording of an explosion from the recording of an earthquake. This new indication, in conjunction with the earlier known method for earthquake identification according to the distribution of signs in the first arrival of a longitudinal wave at the stations surrounding the epicenter, makes it possible in practically all cases to easily recognize the recordings of explosions among those of earthquakes.

Captions for figures 1, 2, 3, and 4, not reproduced here.

Figure 1: Examples of seismograms obtained in Moscow.

(a) P wave during the 19 December 1957 explosion (M~3.9), at the epicentral distance of 2,650 kilometers recorded by the SVK-II seismograph;

Recording of the 25 March 1958 explosion (M~4) at an epicentral distance of 1,440 kilometers recorded by: (b) an SGK-II seismograph; (c) an SGK seismograph; (d) recording of the 5 July 1958 earthquake (43°N, 41.5°E, M = 4 3/4) at 0205:57 hours at an epicentral distance of 1,350 kilometers with an SGK seismograph.

Figure 2. Relationship of the period of longitudinal waves to the epicentral distance.

For earthquakes: (1) $\bar{P}$ wave, (2) P* wave, (3) P_n wave.
For the 19 December 1957 explosion: (4) P_n wave.

The numbers over the points are the depth of the focus; the numbers under the points are the magnitude M; K indicates the foci within the limits of the Earth's crust.

Figure 3. Relationship of the period of transverse waves to the epicentral distance for earthquakes:

(1) $\bar{S}$ wave,
(2) S* wave
(3) S_n wave

(Other designations are the same as in Figure 2.)

Figure 4. Relationship of the maximum period of surface waves to the epicentral distance:
(1) for earthquakes (a - indicate the experimental points);
(2) for explosions (b - indicate the experimental points).

("Differences in the Periods of Seismic Waves Stimulated During Underground Explosions and Earthquakes," by S. D. Kogan, I. P. Pasechnik and D. D. Sultanov, Institute of the Physics of the Earth imeni O. Yu. Schmidt, Academy of Sciences USSR; Moscow, Doklady Akademii Nauk SSSR, Vol 129, 1959, No 6, pages 1,283-1,286)

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VII. ARCTIC AND ANTARCTIC

A New High-Latitude Expedition

The following is the text of a brief notice recently appearing in Pravda.

"Every year in the spring, when clear sunny days set in and the drift ice has still not been subjected to summer thawing, the research work of Soviet air expeditions begins anew in the high latitudes of the Arctic. The next expedition, "Sever-12," is now in preparation."

"In a conversation with a correspondent of Pravda, V. V. Frolov, Director of the Arctic and Antarctic Institute, reported as follows:"

"The high-latitude expedition "Sever-12" will make brief landings on the ice of several groups of scientists in various regions of the Arctic Ocean. They will accomplish oceanographic, ice research and geophysical work. This will continue the systematic research which has been conducted in the Central Arctic during the entire period of the post-war years."

"In addition, the air expedition will organize a ninth scientific research drift station to the northwest of Wrangel Island. Each of the participants in the forthcoming drift of the station "Severnyy Polyus-9" (abbreviated "SP-9") will combine 2 or 3 specialties. This, while maintaining the established scope of research activities, will considerably decrease the total number of station personnel required."

"A change will also be made in the personnel assigned to the drift station "SP-8." The present staff of polar specialists at this station has worked under exceptionally difficult conditions. From the beginning of the drift, beginning in April of last year, the ice floe has taken an extremely tortuous route and has greatly decreased in size." ("Sever-12," Pravda, 9 February 1960, page 4)

Thermal Regime of the Snow Cover in Antarctica

This article considers the peculiarities of the radiational and thermal properties of the upper layer of the snow cover; this has not been adequately treated in Antarctic research literature. A variety of instruments were used at such Soviet stations as Mirnyy and Pionerskaya to measure temperature at surface level and a number of subsurface levels as far down as 16 meters. It is data collected on the Second Antarctic Continental Expedition that serves as the basis for this paper.

The following conclusions may be drawn from this research:

1. The resulting quantitative indices for the radiational and thermal properties of the snow, thermal exchange and distribution of temperature at various depths, reflect the conditions of the formation of the snow cover in Antarctica.

2. The current of total radiation in Antarctica in the summer, as a result of the great transparency of the atmosphere, is considerably greater than in the Arctic and is even greater than in equatorial latitudes.

3. The mean annual value of the albedo of the snow cover on the Antarctic coast varies from 83% in the summer to 92% in the winter. The percentage of absorbed short-wave radiation is 15-18% in the summer and 8-10% in the winter. This insignificant part of the incoming radiation is the basic source of heat reaching the snow cover.

4. The cooling of the snow surface due to radiation is so great that even the considerable velocity of the wind characteristic of the coast does not lead to dissolution of inversions in the near-surface layer of the atmosphere.

5. The changeability of the radiational and thermal properties of the snow in time is not great; this indicates the low intensity of development of thermal processes and of phase transformations taking place in the upper layers of the snow. ("Thermal Regime of the Snow Cover in Antarctica," by I. D. Kopanev, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, 1959, pages 1,831-1,838)

New Valley Discovered in Antarctica

A newly discovered valley in eastern Antarctica was named the International Geophysical Year by the Interdepartmental Commission for the Study of Antarctica of the Academy of Sciences USSR.

The northern portion of this gigantic valley near Olaf Prydz Bay was explored by the united forces of an Australian, British and American expedition. Further along toward the Pole of Relative Inaccessability, where the valley borders the Sovetskoye mountain plateau, it was studied by an Antarctic expedition of the USSR. The valley's length is about 1,300 kilometers, and its average width about 600 kilometers. The most accurate outline of this valley was first given only on Soviet published maps. ("Antarctic News"; Moscow, Izvestiya, 14 February 1960, page 4)

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